

QUIZ 1 FOR M325K

Name: _____
 UT EID: _____

- (1) [2 points] Define *logical equivalence*
 Two propositions P and Q are *logically equivalent* if they have the same truth tables.
- (2) [2 points] Give the *De Morgan's Laws*

$$(p \wedge q) \vee r \equiv (p \vee r) \wedge (q \vee r) \quad (p \vee q) \wedge r \equiv (p \wedge r) \vee (q \wedge r)$$

- (3) [4 points] Verify the logical equivalence

$$(p \wedge q) \vee r \equiv (p \vee r) \wedge (q \vee r)$$

by completing the truth table below

p	q	r	$p \wedge q$	$p \vee r$	$q \vee r$	$(p \wedge q) \vee r$	$(p \vee r) \wedge (q \vee r)$
1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1
1	0	1	0	1	1	1	1
1	0	0	0	1	0	0	0
0	1	1	0	1	1	1	1
0	1	0	0	0	1	0	0
0	0	1	0	1	1	1	1
0	0	0	0	0	0	0	0

What is it about the truth table which shows the expressions are logically equivalent ?

Both expressions have the same final truth table as given in the rightmost two columns of the truth table.

- (4) [2 points] Explain why this also proves

$$(p \wedge q) \vee (\neg p \wedge \neg q) \equiv (p \vee (\neg p \wedge \neg q)) \wedge (q \vee (\neg p \wedge \neg q))$$

This logical equivalence is obtained from the previous one by replacing r by $(\neg p \wedge \neg q)$.